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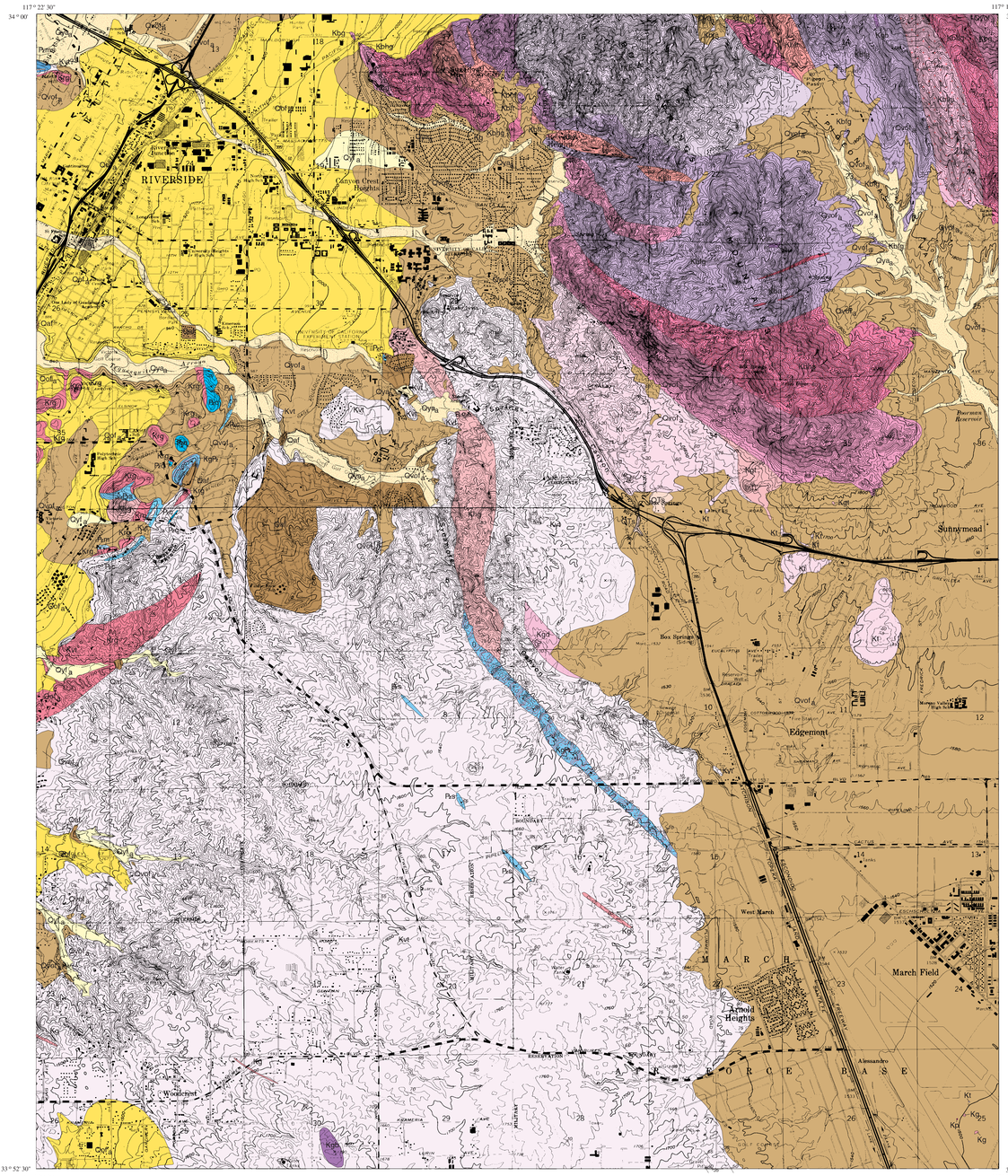

Base from U.S. Geological Survey
7.5' Riverside East quadrangle, 1967
Polyconic projection

Geology mapped by D.M. Morton, 1988, 1996-7, and B. Cox, 1988

SCALE 1:24,000

1 MILE

1 KILOMETER

CONTOUR INTERVAL 20 FEET

GEOLOGIC MAP OF THE RIVERSIDE EAST 7.5' QUADRANGLE, RIVERSIDE COUNTY, CALIFORNIA

Version 1.0

By

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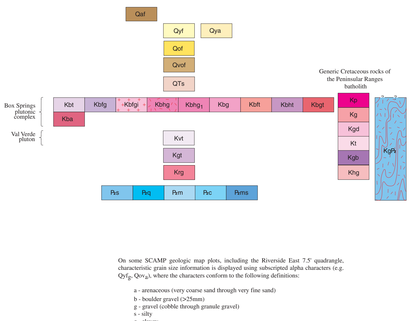
CORRELATION OF MAP UNITS



On some SCAMP geologic map plots, including the Riverside East 7.5' quadrangle, characteristic grain size information is displayed using subscripted alpha characters (e.g. Qyf_g, $Qtrv_{sg}$), where the characters conform to the following definitions:

a - areaceous (very coarse sand through very fine sand)
b - boulder gravel (>25mm)
g - gravel (cobble through granule gravel)
s - silty
c - clayey
m- marl
p - peat

In the **Description of Map Units**, the Ma following U/Pb ages has an attached subscript; Ma_d for isotope dilution analyses, and Ma_{ip} for ion probe analyses.

Contact—Generally located within ±15 meters

Fault—High angle. Strike-slip component on all faults is right-lateral; dip-slip component is unknown, but probably reflects valley-highland relations. Dashed where located within ±30 meters; dotted where concealed. Arrow and number indicate measured dip of fault plane that was exposed in trench.

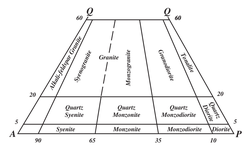
Strike and dip of igneous foliation
Inclined
Vertical

Strike and dip of metamorphic foliation
Inclined
Vertical

Strike and dip of joints in igneous rocks
Inclined
Vertical

Bearing and plunge of linear features
Inclined

SURROUNDING 7.5' QUADRANGLES



Classification of plutonic rock types (from IUGA, 1973, and Streckeisen, 1973). A, alkali feldspar; P, plagioclase feldspar; Q, quartz.

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic Code. Any use of trade, firm, or product names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. Government.

This map was printed on an electronic plotter directly from digital files. Dimensional calibration may vary between electronic plotters and between X and Y directions on the same plotter, and paper may change size due to atmospheric conditions; therefore, scale and proportions may not be true on plots of this map.

Digital files available on World Wide Web at http://geopubs.wr.usgs.gov

DESCRIPTION OF MAP UNITS

VERY YOUNG SURFICIAL DEPOSITS—Sediment recently transported and deposited in channels and washes, on surfaces of alluvial fans and alluvial plains, and on hillslopes. Soil-profile development is non-existant. Includes:

Artificial fill (late Holocene)—Deposits of fill resulting from human construction or mining activities; restricted to large area of regrading related to residential development in west central part of quadrangle and several smaller areas nearby

YOUNG SURFICIAL DEPOSITS—Sedimentary units that are slightly consolidated to cemented and slightly to moderately dissected. Alluvial fan deposits (Qyf series) typically have high coarse:fine clast ratios. Younger surficial units have upper surfaces that are capped by slight to moderately developed pedogenic-soil profiles (A/C to $A/C/B_{cambic}/C_{ox}$ profiles). Includes:

Young alluvial fan deposits (Holocene and late Pleistocene)—Gray-brown sand and cobble- and gravel-sand deposits derived chiefly from rocks of Peninsular Ranges batholith. Found in restricted drainages along west edge of quadrangle, but contiguous with much more extensively developed deposits west of quadrangle

Young axial channel deposits (Holocene and late Pleistocene)—Gray, unconsolidated alluvium consisting of medium- to fine-grained sand and lesser silt flooring several low relief valleys and their tributaries in northwestern and northeastern part of quadrangle. Includes sediments in Tequesquite Arroyo and Pigeon Pass Valley

OLD SURFICIAL DEPOSITS—Sedimentary units that are moderately consolidated and slightly to moderately dissected. Older surficial deposits have upper surfaces that are capped by moderately to well-developed pedogenic soils (A/AB/B_{COX} profiles and Bt horizons as much as 1 to 2 m thick and maximum hues in the range of 10YR 5/4 and 6/4 through 7.5YR 6/4 to 4/4 and mature Bt horizons reaching 5YR 5/6). Includes:

Old alluvial fan deposits (late to middle Pleistocene)—Indurated, sandy alluvial fan deposits developed extensively in western part of quadrangle. Most of unit is slightly to moderately dissected and reddish-brown. Some Qof includes thin, discontinuous surface layer of Holocene alluvial fan material

VERY OLD SURFICIAL DEPOSITS—Sediments that are slightly to well consolidated to indurated, and moderately to well dissected. Upper surfaces are capped by moderate to well developed pedogenic soils (A/AB/B_{COX} profiles having Bt horizons as much as 2 to 3 m thick and maximum hues in the range 7.5YR 6/4 and 4/4 to 2.5YR 5/6)

Very old alluvial fan deposits (early Pleistocene)—Mostly well-dissected, well-indurated, reddish-brown sand deposits. Commonly contains duripans and locally silcretes. Forms large area in southeastern part of quadrangle in area of March Air Force Base, and numerous smaller areas in northern part of quadrangle. Derived chiefly from rocks of southern California batholith

Unnamed late Cenozoic sedimentary rocks in Riverside and Corona areas (early Pleistocene to late Pliocene?)—Lithologically diverse, moderately indurated, gray to brown, coarse-grained sandstone, pebbly sandstone, and conglomerate. Restricted to two small areas near southeast end of Box Springs Canyon. In the Riverside West 7.5' quadrangle, most clasts in unit were derived from San Bernardino Mountains. In Riverside East 7.5' quadrangle, appears to be derived from units found in Santa Ana River drainage. Southeast of Riverside, clasts are locally derived from Peninsular Ranges sources

Box Springs plutonic complex (Cretaceous)—Box Springs plutonic complex is an elliptical, horizontally-floored basin-shaped granitic complex centered on Box Springs Mountains; apparently lower part of granitic diapir. Layering and foliation in granitic rocks is primary. Complex consists of essentially massive to indistinctly primary layered biotite tonalite in core, surrounded by layer of foliated biotite granodiorite to tonalite. Further outward in complex is discontinuous layer of foliated, heterogeneous, porphyritic granodiorite, succeeded by uniform porphyritic granodiorite. Other compositionally and texturally diverse granitic rocks also occur within complex, but in relatively small amounts. All rocks of complex were included in Perris quartz diorite by Dudley (1935) and in Bonsall tonalite by Larsen (1948). Except for dike rocks, units are described in general order from core outward. Includes:

Biotite tonalite—Massive, fine- to medium-grained, equigranular biotite tonalite. Much has faintly to moderately developed, very regular compositional layering. Rocks contain about 35 to 40 percent quartz and 6 to 12 percent biotite. Hornblende is absent and potassium feldspar ranges from 1 to 4 percent. Mineral alignment is poorly developed or absent, but much of rock has incipient to well-developed primary layering defined by mineral concentrations. Unit contains sparse equant- to elliptical-shaped, fine-grained, mesocratic inclusions; some have relatively mafic rims. Inclusions tend to be aligned parallel to compositional layering. Zircon ages of rock are 98.6 Ma_{ip} and 100.4 Ma_{ip}

Biotite granodiorite and tonalite—Light gray, medium- to coarse-grained, foliated biotite granodiorite and tonalite. Contains 25 to 35 percent quartz, 8 to 15 percent biotite, and minor hornblende. Potassium feldspar occurs as small interstitial grains and sparse, subhedral phenocrysts up to 1.5 cm in diameter. Potassium feldspar content appears to decrease progressively inward; tonalite most abundant in inner part. Mesocratic discoidal inclusions oriented parallel to foliation are common, but not abundant. Grades into biotite tonalite unit (**Kbt**)

Biotite granodiorite and tonalite containing abundant inclusions—Biotite granodiorite and tonalite that contains abundant discoidal, mafic inclusions; restricted to east side of complex

Heterogeneous porphyritic granodiorite—Heterogeneous porphyritic granodiorite and subordinate tonalite. In most places surrounds biotite granodiorite and tonalite unit (**Kbfg**). Pinches out along west side of complex. Medium- to coarse-grained, light gray, foliated, and porphyritic. Quartz ranges from 25 to 35 percent; mafic minerals, biotite and subordinate hornblende, from 10 to 15 percent. Mafic minerals unevenly distributed imparting heterogeneous appearance to rock. Subhedral potassium feldspar crystals are up to 2.5 cm in length. Widespread discoidal mesocratic inclusions oriented parallel to foliation. Cut by numerous dikes of leucocratic granite and pegmatite

Layered heterogeneous porphyritic granodiorite—Heterogeneous porphyritic granodiorite having pronounced layering that is defined chiefly by variations in grain size. Restricted to single mass west of Sugarloaf Mtn in north-central part of quadrangle

Porphyritic granodiorite—Coarse-grained, light gray, foliated, porphyritic biotite granodiorite and subordinate tonalite. In most places grades into heterogeneous porphyritic granodiorite unit (**Kbhg**). Groundmass is plagioclase, quartz (30 to 40 percent), and mafic minerals (5 to 10 percent). Mafic minerals are biotite and sparse hornblende, which are more evenly distributed than in heterogeneous granodiorite (**Kbhg**). Subhedral potassium feldspar phenocrysts are up to 2.5 cm in length. Discoidal mesocratic inclusions are oriented parallel to foliation

Biotite-hornblende tonalite—Light to medium gray, medium- to coarse-grained, foliated tonalite. Forms discontinuous, pod-shaped masses surrounding, but not in contact with, biotite tonalite (Kbt). Contains 20 to 25 percent quartz and about 25 percent biotite and hornblende in subequal amounts. Hornblende and biotite occur as ragged crystals. Potassium feldspar present, but very sparse. Anhedral, interstitial sphene is conspicuous accessory mineral. Contains abundant, fine-grained, mesocratic, ellipsoidal- to discoidal-shaped mafic inclusions aligned parallel to foliation

Heterogeneous biotite tonalite—Light-gray, inequigranular, medium- to coarse-grained, foliated biotite tonalite; restricted to northwestern Box Springs Mountains. Leucocratic, containing 1 to 4 percent biotite, which occurs as thin, subhedral plates, irregularly concentrated and aligned to produce wispy, swirled foliation. Leucocratic tonalite encloses pods and lenses of tonalite containing about 15 percent biotite as large ragged plates. Both types of tonalite contain abundant quartz (30 to 40 percent) and very sparse potassium feldspar (1 percent or less). Contains dispersed, mesocratic, discoidal inclusions. Granitic pegmatite dikes are abundant

Heterogeneous granodiorite and tonalite—Light- to medium-gray, medium- to coarse-grained, texturally heterogeneous, foliated, hornblende-biotite tonalite and granodiorite; restricted to northern Box Springs Mountains near Pigeon Pass. Common discoidal, mesocratic inclusions oriented parallel to foliation

Amphibolitic gabbro—Dark-gray to black, fine- to medium-grained, foliated, hornblende-rich amphibolitic gabbro forming lenses and elongate masses within biotite granodiorite and tonalite (Kbfg). Foliation is parallel to foliation in that unit

Val Verde pluton (Cretaceous)—Relatively uniform pluton composed of biotite-hornblende tonalite. Termed Perris quartz diorite by Dudley (1935), Val Verde tonalite by Osborn (1939), and included within Bonsall tonalite by Larsen (1948). Name Val Verde adopted by Morton (1999) based on detailed study of Osborn (1939) near Val Verde, a former settlement and railway siding midway between Perris and Riverside. Apparently steep-walled Val Verde pluton is eroded to mid-pluton level. Emplacement age of the pluton is 105.7 Ma_{ip}. $^{40}Ar/^{39}Ar$ age of hornblende is 100 Ma, biotite 95 Ma and potassium feldspar 88.5 Ma. Includes:

Val Verde tonalite—Gray-weathering, relatively homogeneous, massive- to well-foliated, medium- to coarse-grained, hypautomorphic-granular biotite-hornblende tonalite; principal rock type of Val Verde pluton. Contains subequal biotite and hornblende, quartz and plagioclase. Potassium feldspar generally less than two percent of rock. Where present, foliation typically strikes northwest and dips moderately to steeply northeast. Northern part of pluton contains younger, intermittently developed, northeast-striking foliation. In central part of pluton, tonalite is mostly massive, and contains few segregational masses of mesocratic to melanocratic tonalite. Elliptical- to pancake-shaped, meso-to melanocratic inclusions are common.

Granite of the Riverside area (Cretaceous)—Medium- to coarse-grained, massive- to faintly-foliated, leucocratic biotite granite. Contains about 1 to 3 percent biotite. Inclusions are sparse or absent except locally in western part of body, west of quadrangle, where rock contains 2 to 8 percent biotite and sparse to abundant inclusions of quartz diorite, granodiorite, and fine-grained mafic rock. At Mount Rubidoux, west of quadrangle, rocks contain sparse hypersthene and fayalitic olivine and moderately abundant equant inclusions of dark-gray fine-grained rock

Generic Cretaceous granitic rocks of the Peninsular Ranges batholith

Granitic pegmatite dikes (Cretaceous)—Leucocratic, mostly tabular, pegmatitic-textured granitic dikes. Most dikes range in thickness from a few centimeters to over a meter. Larger dikes are typically zoned compositionally and texturally, having a border and wall zone consisting of coarse-grained biotite, quartz, and alkali feldspars. Intermediate zone consists of large to giant crystals of quartz and alkali feldspars, and commonly contain muscovite, schorl, and garnet. Core zone consists of quartz and alkali feldspars. Line-rock layering is rare

Granitic dikes (Cretaceous)—Includes texturally diverse group of leucocratic granitic dikes composed mainly of quartz and alkali feldspars. Dikes range in thickness from few centimeters to over a meter and are up to several hundred meters in length. Most are tabular; some are texturally and compositionally unzoned, irregular-shaped bodies. Some dike rock has a foliated or gneissoid fabric. Textures are mostly coarse grained and equigranular granitic, but range from aplitic to pegmatitic. Accessory minerals include biotite, muscovite, and garnet

Granodiorite, undifferentiated (Cretaceous)—Intermediate composition granitic rocks, mainly biotite-hornblende and biotite granodiorite; most is massive and medium grained. Restricted to single area just east of Sycamore Canyon

Tonalite, undifferentiated (Cretaceous)—Mainly biotite-hornblende tonalite not associated with specific plutons. Gray, medium-grained, typically foliated. Forms relatively large mass on south side of Box Springs Mountains

Gabbro (Cretaceous)—Mainly hornblende gabbro. Typically brown-weathering, medium-to very coarse-grained hornblende gabbro. Very large poikilitic hornblende crystals in some rocks; locally pegmatitic. Commonly heterogeneous in composition and texture. Includes noritic and dioritic composition rocks. Exposed in southern part of quadrangle and as small masses in biotite granodiorite and tonalite (Kbfg)

Heterogeneous granitic rocks (Cretaceous)—Includes heterogeneous, compositionally diverse granitic rocks mostly of tonalite and granodiorite composition, but includes some monzogranite and gabbro. Mapped in and east of Sycamore Canyon, and near west edge of quadrangle

End rocks of Peninsular Ranges batholith

Intermixed Paleozoic(?) schist and gneiss and Cretaceous granitic rocks (Cretaceous and Paleozoic?)—Intermixed Paleozoic(?) schist and gneiss and Cretaceous granitic rocks, mostly tonalite and granodiorite. Forms elongate mass within Val Verde tonalite (**Kvt**) west of Sycamore Canyon and small mass south of Tequesquite Arroyo

Biotite Schist (Paleozoic?)—Medium-to dark-gray, fine-grained biotite schist and biotite-quartz-feldspar schist. Locally contains sillimanite and cordierite. Commonly includes minor amounts of quartzite and calc-silicate hornfels. Limited exposures in hills south of Tequesquite Arroyo, and as pendants in Val Verde tonalite

Impure quartzite (Paleozoic?)—Quartzite; impure, light-gray to light-greenish-gray, fine-to medium-grained, layered to massive. Limited exposures in hills south of Tequesquite Arroyo

Marble (Paleozoic?)—Marble; white to light-gray, locally bluish-gray and blue, coarse to extremely coarse grained

Calc-silicate rocks (Paleozoic?)—Heterogeneous, massive to well-layered calc-silicate rocks

Marble and schist, undifferentiated (Paleozoic?)—Intermixed marble, calc-silicate rock, and biotite schist. Mapped on North Hill in northwestern part of quadrangle

GEOLOGIC SUMMARY

The Riverside East quadrangle is located in the northern part of the Peninsular Ranges Province within the central part of the Perris block, a relatively stable, rectangular in plan area located between the Elsinore and San Jacinto fault zones.

The quadrangle is underlain predominantly by Cretaceous plutonic rocks which are part of the composite Peninsular Ranges batholith. Within the quadrangle, the batholithic rocks represent a wide variety of mafic to intermediate composition granitic rocks ranging in composition from monzogranite to gabbro, but tonalite predominates. Most of the granitic rocks are faintly to intensely foliated. Many are heterogeneous and contain varying amounts of meso-and melanocratic discoidal-shaped inclusions. Some rock is composed almost wholly of inclusion material and some are migmatitic. Included within these granitic rocks are a few septa of Paleozoic(?) biotite schist, marble, and calcsilicate rock of upper amphibolite metamorphic grade.

Metamorphic rocks of Paleozoic(?) age occur primarily in the northwest part of the quadrangle. These rocks include coarse-grained marble bodies that have been quarried in the past. North Hill, at the northwest corner of the quadrangle is the site of the 'Old City' quarry, where tonalite intrudes marble producing pyroxene-hornfels grade garnet-pyroxene skarn. South of Riverside several disconnected bodies of marble, impure quartzite, and calcsilicate rock were quarried at the 'New City' (Victoria Ave) quarry. There, the thicker of the two marble bodies was quarried exposing skarn developed at a contact between the marble and intrusive biotite-hornblende tonalite. The composition of the skarn is highly varied and includes pyroxene-grarnet, idocrase, scapolite-pyroxene, and magnetite-pagoite skarns.

Biotite-hornblende tonalite of the relatively large Val Verde pluton dominates the quadrangle west of Interstate 215. In most places this tonalite has a northwest oriented crude to well developed planar fabric produced by oriented biotite and hornblende. In the northern part of the pluton northeast striking planar fabric dominates. Schlieren and massive clots of mafic tonalite occur locally. Discoidal-to pancake-shaped mafic inclusions are widespread and are oriented in the plane of the biotite and hornblende. Typically, the planar fabric dips moderately to the northeast, but is locally horizontal to subhorizontal or grades to an isotropic fabric.

Granitic rocks in the northeastern part of the quadrangle are part of the Box Springs plutonic complex. This composite intrusion is an elliptical, flat-floored granitic complex centered on the Box Springs Mountains. The exposed part of the complex is apparently the lower part of a granitic diapir. In the center of the complex massive to indistinctly primarily layered biotite tonalite grades outward into a well foliated biotite tonalite. Further outward the rocks are a heterogeneous assemblage of primarily granodioritic plutonic rocks.

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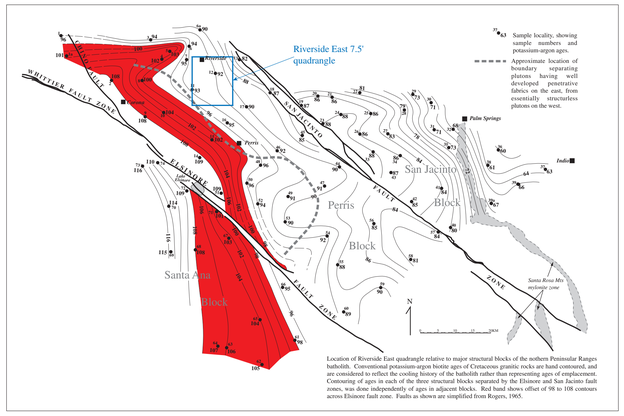

Location of Riverside East quadrangle relative to major structural blocks of the nothern Peninsular Ranges batholith. Conventional potassium-argon biotite ages of Cretaceous granitic rocks are hand contoured, and are considered to reflect the cooling history of the batholith rather than representing ages of emplacement. Contouring of ages in each of the three structural blocks separated by the Elsinore and San Jacinto fault zones, was done independently of ages in adjacent blocks. Red hand shows offset of 98 to 108 contours across Elsinore fault zone. Faults as shown are simplified from Rogers, 1965.